

JPRS: 4837

2 August 1961

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SEP 7 1961

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TRANSLATIONS ON HYDROGEOLOGY AND ENGINEERING GEOLOGY  
IN COMMUNIST CHINA

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## F O R E W O R D

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JPRS: 4837

CSO: 1559-S/h,i,  
k-m

TRANSLATIONS ON HYDROGEOLOGY AND ENGINEERING GEOLOGY  
IN COMMUNIST CHINA

[The following are translations of selected articles from Shui-wen Ti-chih Kung-ch'eng Ti-chih (Hydrogeology and Engineering Geology), Peiping, Number 6, 12 June 1959]

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## PRELIMINARY KNOWLEDGE IN STIMULATING AND ORGANIZING A HIGH-TIDE OF PRODUCTION

[Following is the translation of an article by Ch'u Shao-i (7798 1421 6654) and Chang Wen-yen (1728 2429 3508) in Shui-wen Ti-chih Kung-ch'en Ti-chih, No. 6, 12 June 1959, pp. 34-35.]

Based on the slogan, "Take immediate action; start in the last ten days of the month to attain results by the end of the month for above-norm achievement in March," raised by the Party Committee of the Bureau of Geology, Shantung Province, for the month of February, our team has adopted a series of measures promoting a "six comparison" red flag competition movement with technical revolution as its main goal. While the workers' morale has risen to unprecedented heights, the various units have challenged one another in the competition, formulated many production measures, established "red flag platforms," "tournament fields," and "fighting arenas."

The workshop and the six sub-teams have held militant rallies. In the production process everybody is high-spirited with great militancy. In moving camp, when there is no truck the members of the team carry their own belongings, and when there is an inadequate supply of water they draw water with buckets. They have had to move camp a distance of 30 kilometers. They have moved camp and started drilling the same day, attaining new achievements. The No. 310 Mechanical Unit, after drilling to the depth of 150 meters to the sixth layer of rock, are drilling at the speed of 18 to 20 meters per day, one shift of workers drilling nine meters. The No. 6 Sub-Team, using a hand-operated drill, has created the highest record of drilling 27.56 meters.

In the field of technical reforms great results also have been achieved. In February and March, improvements in operational methods have been attained. More than 20 items of tools have been remodeled, such as the rapid drill, the arc-shaped steel-head drill, the long steel-head drill, the composite steel drill, the simplified hole diameter, reformed pipe connecting, and remodelled threaded tubings. On the basis of the workers' unprecedented high morale and to counteract the key problems existing in production, two special meetings have been held for the discussion of drilling and prospecting techniques and mechanical supplies. The technical, the maintenance, and the repair of machinery, and the material supply problems have been solved.

In addition, the cadres from the various offices have organized into working units, penetrating into the various drilling units to inspect and

to help; the cadres are also joining in the work. Thus, the leaders' attitude has been changed. Because of the above measures, a high-tide of production has rapidly been formulated. In March, the mechanical rock center drilling fulfilled 110% of the plan for the month, with a monthly efficiency reaching 312 meters, while the water-drawing test fulfilled 130% of the plan for the month. Geological survey 1:50,000 fulfilled 104% of the monthly plan and 1:25,000 fulfilled 126% of the monthly plan. The manual-operated drilling reached a monthly efficiency of 333 meters, equivalent to 241% of the monthly plan. In the process of stimulating and organizing the high-tide of production, we have attained the following several concepts.

### 1. To Organize a Production High-Tide, Ideology Must Go First

Since spring, the morale among the workers in our team has generally lowered. Some cadres in the leading positions in the sub-teams said, "We do as much as we can." Other said, "Our task in January is too great; it cannot be easily fulfilled." Because the weather is getting colder, the old new year will soon arrive. The workers' morale fluctuates greatly and it is not as high as it used to be. The above situation has a very great effect on the all-out fulfillment of the production task. In order to counteract this problem, the Party Committee held a meeting with the secretaries of the various Party Branches participating. At the meeting, the Party Committee earnestly exerted the spirit of the Third Meeting of the First Shantung Provincial Party Delegates' Conference and the instructions from the Party Committee of the Provincial Bureau of Geology which launched the "six comparisons" red flag competition movement which has technical revolution as its main goal.

The meeting thoroughly criticized the attitude of dreading difficulties, analyzed the advantageous factors in the fulfillment of a task, and through discussion, an understanding was reached and in ideology clarified by establishing the ideology that the entire team is like a game of chess and a book of records, and encouraging militant confidence to over-fulfill the task. The spirit of the meeting of the secretaries of the Party Branches has thoroughly enabled the masses to have a plan in mind and have sufficient confidence in fulfilling their task.

For instance, the Party Branch of the First Sub-Team penetratingly implemented the spirit of the secretaries' meeting, thoroughly criticizing the passive waiting ideology which said, "Wait till all problems have been solved, then we will promote a high tide." It has formulated over-all measures to promote a high-tide of production (a slogan which says, "To attain victory at every move and to rise step by step"). These measures have strengthened the workers' confidence. Thus, the production task has been over-fulfilled ahead of schedule.

In the red and special "drilling unit" of the Fourth Sub-Team, the five systems were not well implemented in the past. Political ideology was not held well, no meeting was conducted, and following the New Year's holidays no mechanical meeting has ever been held. Living standards have

slackened. After working hours those who have families just return to their families, while those who have not just roam the streets. There is no solidarity between the one shift of workers and another nor between the new and old workers. As a result, the production task of January and February has not been fulfilled. Later, after the promotion of the six comparisons red flag competition movement that has technical revolution as its main goal, the nucleus leading power of the mechanical meeting has been strengthened, the solidarity problem has been solved, the living conditions have been intensified, systems have been adhered to, ideological work has been strengthened, morale has been raised, and a vigorous high-tide of production has been created.

For instance, the drilling and prospecting task of that mechanical unit has fulfilled 54% of the plan in January, 79% in February, and 110% in March. All these changes have profoundly educated us and only after the ideological problems have been solved can the great leap forward in production be promoted. Only through paying attention to holding fast to ideology can the ideological problem be solved in time.

## 2. To Promote a Mass Movement, Start Competition, Judgment, and Comparison

We have deeply realized that in promoting a high-tide of production, it is not possible to adopt a safe working method; we must make a great show, promote a mass movement, and launch a great campaign. Since the great leap forward last year, we raised one slogan after another, and the high-tide of production rose higher and higher. At the time, the workers' morale was very high and production rose month after month. Later, no more slogans were raised, and a recession occurred. The workers' morale was not so high as before and production was gradually lowered. On the contrary, more ideological disputes arose. But since February of this year, when the "six comparisons" red flag competition movement with technical revolution as its main goal was launched, the situation has again changed.

The workers have universally formulated plans for the leap forward, accepted challenges, raised their morale and the number of ideological disputes has been reduced. In the process of a "saddle-shaped" development, we have been educated that the workers' morale can be aroused but not frustrated. Competition should be vigorously promoted.

We must stress again that the great show and vigorous movement must be established on a factual basis and superficiality should be avoided. For instance, the promotion of the "six comparisons" red flag competition movement which as technical revolution as its main goal is in itself a vigorous form and has an over-all content.

How is this movement to be promoted? Our methods are, first, we must strengthen the organization of leadership. The team must first organize a production directing headquarters. The team's technical reform committee must be enlarged, adding four small professional units: political promotional unit, technical study and expansion unit, guaranteed material supply unit, repair and technical reform experimental unit. The technical reform committee (or unit) of the sub-team or the workshop must be adjusted and sup-

plemented, making regular studies on the competition and the production techniques, summarizing the experiences and making timely promotions. Each mechanical unit, besides strengthening the nucleus of leadership of the mechanical meeting and the four professional control units (the drilling machine, the diesel engine, the tools and the water pump, the records and supply control) also establishes a learning unit and a safety unit.

Second, we must raise action slogans, promote the workers to formulate plans and accept challenges. Based on the over-all conditions, the team should raise action slogans such as two fasts (fast drilling and fast evaluation), five guarantees (guarantee safety, guarantee regular operation, guarantee quality, guarantee the lowering of production cost, and guarantee supply), four catch up (transportation catch up, installation catch up, water pumping catch up, pipe raising catch up), a game of chess (the team and the sub-team must establish the ideology of a game of chess and a book of records and promote communist cooperation). Once a slogan is raised, it should be followed by leadership, organization, plans, and preparation. The mechanical unit, the workshop, the unit, and the shift of workers must adopt measures to promote a labor competition between one mechanical unit and another, between one workshop and another, between one unit and another, and between one shift of workers and another.

We must again carry out the weekly record, monthly judgment, and quarterly reward system, under which inspections, judgments, and comparisons are made.

3. To Clearly Indicate the Policy of Production Service, Use of "Efficiency, Quality, and Storage" as an Outline for the Motive Power in Leading an All-Out Great Leap Forward in Production

The 1959 policy for the development of national economic construction is the earnest implementation of the Party's general line, under which "morale is highly aroused, striving for the upper stream and fulfilling our task in the more, faster, better, and cheaper manner," for the construction of socialism, and the complete set of the "walking on two legs" plan. Based on the State's economic construction policy, the Shantung Provincial Bureau of Geology has contributed the policy of "having the Central Government and the local government carry out geological work at the same time, the professional teams and the masses to prospect large, medium, and small mines at the same time, guaranteeing the needs of the industries operated by the Central Government and those of the local industries at the same time, and applying foreign and domestic methods for production at the same time." This set of walking on two legs policies must be coordinated with scientific studies and production, and concentrated leadership and mass movements must be coordinated. As for the hydro-geological and the engineering geological work for our team, they must be arranged in accordance with the State's economic construction and under the general policy of geological works. Our slogan is "Proper concentration, steel the keypoint, paying attention to universal investigation, and consideration to the general situation."

In arranging the items of prospecting, accurately concentrate all powers and guarantee the State's keypoints. Give full consideration to local and other items of work. This is the main principle that "the entire country is like a game of chess." Based on the distribution of the six sub-teams under our team, they are separately concentrated at six steel and iron bases: Chi-nan, Tzu-po, Lin-i, I-hsien, Lai-wu, and Ch'ang-wei. This shortens the front, facilitates production, and protects the key-points, which promotes the entire situation.

After the policy has been clarified, we must hold fast to "efficiency, quality, and storage" and we must use this outline to lead all production to an all-out great leap forward. To hold fast to efficiency means fast drilling, full use of the time, few accidents, proper maintenance and repair for machinery, followed with rapid installation and pulling out of the pipes. To hold fast to quality means that geological work must catch up, rock sampling must be high, and material gathered must be accurate. To hold fast to storage means that water pumping work and office work must catch up with mechanical operations. After all these, in actual production we can realize that they will have a great effect on the promotion of production.

#### 4. Always Try to Discover Problems and Solve Them Immediately

To hold fast to a problem and solve it immediately is the important method by which our team has changed the appearance of production. We have just entered the tense winter production period. The workers' morale is very high. Later, because the weather has become more severe, most of the apprentices and contracted workers have no cotton-padded clothes and comforters and because the New Year holidays are coming, these workers are homesick so there are great fluctuations in their ideology. Many apprentices and contracted workers want to quit working; some even run home without asking for leave. This situation seriously affects existing production. After the leaders discovered this problem, they held fast to living conditions, solved the problem of keeping the workers in the fields warm. They requested the local government to provide cotton cloth so that cotton-padded clothes and cotton comforters could be made for the apprentices and contracted workers.

During the New Year holidays, the workers are given leaves to visit their relatives. After all these problems are solved, everybody has new confidence in production and their morale has risen again. Here we deeply realize that the Party's instruction, "The greater the masses' morale, the more the Party should give consideration to the masses' living conditions," is extremely correct. Again, when we have discovered that production is universally lowering, we analyze its causes, principally because people do not have sufficient understanding of existing production and they are willing to bow their heads to the winter weather. Besides these, the mechanical equipment is too old, and there is an inadequate fuel supply. As such, we hold fast to this problem and call a Party Branch secretaries' meeting and two professional meetings, the mechanical drilling and pros-

pecting, the supply and technical problems. The Party Branch secretaries meeting has changed the incorrect ideological understanding. The mechanical and supply meeting adopted measures for mechanical control and the existing supply activity in 1959, balanced the distribution of materials in the first quarter, and solved some of the urgent problems concerning material supplies. The drilling and prospecting meeting also attained preliminary solutions to problems such as water leaking, the drilling of hard sand and gravel layers and the improvement of the wooden hammering drill. After these problems were solved, production was promoted.

The above knowledge is unfinished. It has been submitted here merely as reference material. We still have many defects in our work, and these will require greater efforts on our part in the future in order to overcome them.

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## ON OVERCOMING DEFICIENCIES OF TECHNICAL FORCES AND MATERIAL IMPLEMENTS

[Following is the translation of an article by Chiang Ming-ta (5592 2494 6671) in Shui-wn Ti-chih Kung-ch'en Ti-chih, No. 6, 12 June 1959, pp. 35-36.]

In this era when the commander's flag is flying high and the war drums are sounding violently, the hydrogeological and engineering geological team of the Kansu Provincial Bureau of Geology have attained a prospect for a leap forward greater than that of last year, though its working area is more scattered this year, extending 1,700 kilometers from east to west.

Two comprehensive sub-teams, working from west to east, have covered more than 1,000 kilometers. Because some have been called away, the technical force has been weaker than that in the past. These facts have created greater difficulties in their work.

But, under the brilliance of the general line, we firmly implemented the instructions from the superior Party Committee and the Bureau of Geology, "Be humble, self-providing, rely on the masses, and cooperate in every way." Thus, we have overcome the deficiencies of technical force, materials, and of fuel supplies and the difficulty of untimely repairs. The team went to work 25 days earlier than last year and it has fulfilled the amount of work in the first quarter five times greater than that of the same period last year. They are able to overcome the above difficulties and have attained obvious results. There are several understandings such as:

1. The Party's leadership is the basic guarantee for self-providing in overcoming difficulties. Following this, there is a greater prospect for an all-out leap forward this year, although there is difficulty in raw materials, equipment, fuel supplies, and transportation. In addition, because the prospecting areas are widely scattered, the three repair plants under the Bureau have carried a very heavy burden, and cannot make timely repairs, welding the drill heads and urgently needed repairs such as repairing implements that have broken down. Furthermore, because this year's task is great and because of the deficiency of the technical forces, some comrades have lost some of their confidence. To counteract this situation, the Party Branches of the team and the sub-teams, based on the spirit of the instructions from the superior Party Committee, have repeatedly organized discussions so that everybody knows that it is a partial tension in the great leap forward, and a temporary difficulty on the road of progress. It is a good thing because it is the motive force that urges us to march forward. It enables the workers to make full preparations ideologically so

they will not be caught unprepared, nor are they passively waiting, but can follow the instructions from their superior Party Committee "to strive for self-providing, struggle for reinforcement and outside aids," and "to use the old to substitute for the new, the native to substitute for the foreign, to make what they need, to enforce economy, to carry out internal and external cooperation and to train themselves" and they have thought out many solutions to their problems.

When a prospecting team reaches a place, it reports to the local Party Committee which gives the team instructions. Under the instructions and support of the local Party Committee, many production problems have been solved. For instance, its equipment is given priority in processing and repair, the team is provided with materials, fuel, animals, and carts for the transportation of earth and the delivery of water, and even problems of food and living quarters are solved for all the members of the team. All these have facilitated the work of the prospecting team.

2. Eyes look down in order to be self-providing. To promote a mass movement is an important method of overcoming difficulties. In the past, when workers met any difficulty they would ask their superiors for methods. Some people believed that the workers could only labor, while the solving of problems was the superior's duty. Some people had the rightist conservative ideology that "a skillful woman cannot cook a meal without rice," and they believed that when there was a shortage of raw materials, materials and fuel, work could not be continued. Since the great leap forward, under the Party's guidance, the masses are fully aroused, they use their brains, bring out methods, and many problems have been solved.

(1) This year there was a shortage of fuel in February and March, six cars being stopped from work for ten days on account of the fuel shortage. Through the workers' repeated discussions they adopted economy measures and the fuel shortage problem was solved.

(a) To utilize the air-pressure machine to experiment with water pumping. Generally, when water is supplied for drilling a hole, three empty trips have to be pumped. After the technicians discussed the problem, they believed that when the earth layer is simple and the water level stabilized, the hole, after two empty trips, would have been calculated, would meet the quality needs, and they would not pump the third empty trip so each hole could economize 48 kilograms of fuel.

(b) Now, at holes where the water level is shallow, they are actively trying to install a lotus pod-shaped water pump head in a centrifugal water pump which will substitute for the air-pressure machine.

(c) Thoroughly stopping fuel wastes and such measures have been adopted: keeping the cars at the temperature of 80-90°, letting the car coast down slopes with the gas turned off, and even on level roads trying to let the car glide along whenever it is possible in order to economize fuel. According to statistics, last year a "chi-ssu" car used one kilogram of fuel to run 3.6 kilometers of road. This year it increased to 4.2 kilometers. In addition, a trailer or cart is attached to the car. Fuel has been economized and transportation efficiency has been raised. Last year each air-pressure machine used six kilograms of fuel per hour, but after proper

stoopping of leakage, the consumption is now reduced to five kilograms.

(d) They try to reduce the weight of the drilling machine and the other equipment so that the number of car loads will be reduced. Some working units have made use of the commune's ox-carts, thus economizing fuel which can be used in keypoint production.

(2) The workers and comrades use such methods as economy, development, substitution, remodelling, and creation, and, to a certain extent, have solved the problem of raw material shortage. In hydrogeological drilling, more 150 and 130-millimeter drill heads are needed. The workers and comrades use the old drill heads, sharpen the edges, add some alloys, and each head is used one to two additional times. In order to stop the water at the various layers of earth, several sets of pipes are used for each hole. The workers learned the experience of their sister teams and use wooden filtering pipes instead of steel pipes.

(3) Because the working areas are scattered and the teams move about very widely, the team's original repair shop merged with the Provincial Bureau's repair plant. All processing and repair jobs are listed in accordance with a plan. Any temporary or urgent processing and repair job cannot be done on time. In order to solve this problem, they have adopted the following methods:

(a) Send a portion of the repair jobs to the plant that can be done. According to the processing plan, the various related repair plants, when arranging their monthly production plans, make certain allowances for temporary repairs.

(b) Each sub-team uses one mechanical repair worker as the basis and organizes a repair unit, solving small repair jobs and on-the-spot inspection and repairs. For instance, No. 2 Sub-Team has only one mechanical repair worker. Later, from the temporary workers they found a copper worker and the labor department has introduced an old iron worker; thus, a repair unit has been organized. At the beginning, the only tool they had was an anvil, the rest composed only of crude tools. They started from nothing and the materials they used were old and scrap materials. In January and February this unit processed and repaired over 300 pieces of tools. It also produced Lo-yang shovels, hand-operated drills, repaired several dozens of broken oil pipes that have been stored for several years, and welded a number of iron water tanks that were broken last year. No. 4 Sub-Team utilized the 500 model drill machine as the basic frame to produce a power-operated or mule-drawn dual-use native lathe, which processes spare parts. It also used the mechanical workers and the leader of the mechanical unit as the nucleus to arouse the wisdom and morale of the masses, and this unit has repaired over 20 old oil sprayers, which is the most difficult problem that confronts it and it has guaranteed to meet all the needs in production.

(c) Through the local Party Committee, they strive to attain the support from local repair shops. For instance, the cars in No. 3 Sub-Team are in bad shape and transportation has become acute. If the cars are sent to the repair plant for a complete overhaul job, it will require 40 to 50 days. Because of the raw material and material shortage, there is no guarantee for time. But at the Wu-wei Labor Reform Plant, after 13 days and nights

of hard work the whole repair job was completed. In Chang-chia-ch'uan Autonomous Hsien, the commune-operated agricultural tool plant processed spare parts for our automatic drill. It tried six times and finally succeeded in making these parts and guaranteed the operation of the drill. When No. 1 Sub-Team tried to weld special alloys on the drill head, it had no welding equipment, but with the support of a certain agricultural tool plant in Ting-hsi, the mechanical workers in this sub-team go to work in this plant and make use of its welding facilities. Thus, the repair problem has been solved.

(4) Promote the technical workers and apprentices to learn many trades, thus the deficiency of technical force is overcome and the supply of technical force is guaranteed.

3. Strengthen communist cooperation.

(1) Internal cooperation: make an inventory of all the warehouses in the various sub-teams. Based on the task, balance all material equipment. Make a mutual exchange between the have and the have-nots. Make purchases locally. Make full use of all materials. Overcome all the difficulties through mutual help.

(2) External cooperation: within the last several years, the Chien-shan Geological Team has always exchanged materials with our team. This year when both sides met serious shortages in materials, we still have exchanged diesel engines and water pump spare parts. Last year, when No. 2 Sub-Team had two rubber tires blown out, the Lu-ch'uan-shan Geological Team came to its rescue. In addition, our team has established cooperative relations with the local geological survey teams, the Ting-hsi Transportation Company, a certain detachment of the Liberation Army, and the Chiu-ch'uan Repair Plant and have mutually supported one another. Our team has done many works to help sister units, such as drilling a well to supply drinking water for a certain detachment of the Liberation Army, investigating the hydrogeological conditions for the construction of an antibiotic manufacturing plant, and coordinating the Ministry of Construction in surveying the water supply in T'ien-shui City for the construction of the Northwest Sub-Institute of the Design Institute. Though these tasks of support are outside the State plan, they help to guarantee keypoint constructions and also help to overcome the difficulties in the work of both sides.

Our team has trained a number of hydrogeological workers for the various special administrative districts, departments, and bureaus, and has trained 170 members for the provinces of Chinghai and Ninghsia so that they can establish geological teams. After graduation, the Chinghai Provincial Bureau of Geology gave our team 30 members, which has overcome our deficiency of technical force.

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OPENING SPEECH OF THE SECOND NATIONAL HYDROGEOLOGICAL AND  
ENGINEERING GEOLOGY WORK CONFERENCE OF THE MINISTRY OF GEOLOGY

[Following is the translation of a speech made by Ho Ch'ang-kung (0149 7022 1562), Deputy Minister of the Ministry of Geology, in Shui-wen Ti-chih Kung-ch'en Ti-chih, No. 6, 12 June 1959, pp. 49-50.]

Comrades:

The Second National Hydrogeology and Engineering Geology Work Conference has just started today. This meeting is based on the rich experiences that have been developed and accumulated during the three years that have elapsed since the First National Hydrogeology and Engineering Geology Work Conference was held in 1956. The central theme of this meeting is a further implementation of the policy of rendering hydrogeology and engineering geology works to serve production construction, a broad exchange and systematic summarization of the working experiences within the last several years, especially those since the great leap forward in 1958.

Good ideological and operational preparations are made in order to realize the continuous leap forward working plan for 1959, to further develop the science of hydrogeology and engineering geology and to make a more all-out implementation of the general line and the "walking on two legs" policy. Thus, there will be "high morale" and a striving for the upper stream and for the construction of socialism in a faster, better, and cheaper manner.

At this meeting, besides many comrades making reports on interesting working experiences and scientific theories, Soviet specialist Adzhabiyev, a hydrogeology expert in the Ministry of Geology, and a Polish expert, K'ai-ssu-lin, who is working in China, and others, will make important reports. Undoubtedly, this meeting will create a high-tide in which everybody will dare to think, dare to speak, and be brave enough to argue so that they will mutually learn from each other. There are 383 delegates and 112 people attending, and many comrades from the sister units have also been invited to come. On behalf of the Ministry of Geology, I extend to all of you a warm welcome and gratitude.

From the First National Hydrogeology and Engineering Geology Work Conference to the present, three years have elapsed. There have been very favorable international and domestic situations for China's socialist construction. On the international scene the situation is just what Chairman Mao has said, "The enemy has become weaker every day, while we have become stronger every day." On the domestic scene, China and the people, after

the all-people rectification movement in 1957, have attained great political and ideological achievements, and have firmly implemented the Party's general line, which has called for "high morale, striving for the upper stream and for the construction of socialism in a faster, better, and cheaper manner." Thus, everybody has a sky-high morale and a militant will. After the great struggle in 1958, throughout the entire country we have attained a prospect for an all-out great leap forward with steel as the outline. Under this encouraging leap-forward prospect, geology work, like all the work on the other fronts, has attained very great achievements, great increases in mineral products, great increases in mining reserves, many important new mineral discoveries, the expansion of the scope of mining prospecting, including hydrogeology and engineering geology, great development in the various types of professional geology teams, and the rising of communist awareness among the workers.

Within the last several years, under the guidance and care of the various levels of Party Committees, the hydrogeology and engineering geology works, whether it be in production practices or in scientific research, have made many accomplishments and provided many materials that are needed for the various types of economic construction. Because the system of sending cadres to the basic level has been carried out, these works have been more closely coordinated with the needs of the development plan for national economy in the various areas.

For instance, the hydrogeological universal investigation of an area is closely coordinated with its industrial, agricultural, and animal husbandry enterprises, the planning of a river valley, and the selected line of a distant river. At the same time, because of the guidance of the local Party Committee, the strengthening of the hydrogeology and engineering geology works has enabled the works to become more adaptable to the actual needs of economic construction in the different areas and under different conditions. Based on the different geological and hydrogeological conditions in the various areas and on the large or small scale of the engineering projects and the different needs for designing, we must adopt and apply an active working procedure. In the case where the scale is not large and the geological conditions are simple, we should adopt the guiding ideology of "while we are making the survey, we should begin to design and start the construction" and a rapid estimation. Thus, hydrogeology and engineering geology works will be more adjusted to the faster, better, and cheaper needs of the general line.

Within the last several years the over-all works we have done are: completed the 1:200,000 and 1:500,000 scale map drawings for 960,000 kilometers of land; 312,000 meters of drilling have been accomplished; prospecting works have been done for water supplies to important cities such as Peiping, Hsi-an, Pao-tou, Chiu-ch'uan, Wu-lo-mu-chi, and Chi-nan; and engineering geology survey works for important State-operated water conservation projects at San-hsia, San-men-hsia, Tan-chiang-kou, and Hsin-an-chiang have been completed. In the field of scientific research there are items that we have completed and that we are undertaking now, including: the classification of China's hydrogeological areas, the distinction of different

of different types of mineral ore hydrogeology, the hydrogeological conditions of the drought areas in the Ho-hsi Corridor, the engineering project of drawing water up from the Tao River and the Karst study of the San-hsia on Chang Chiang. While the above works are being carried out, we have paid attention to the establishment of underground water long-term observation stations and networks, to train cadres and to help some of the special districts and hsien to organize hydrogeology and engineering geology teams, implementing the policy of coordinating professional teams and the masses.

Besides carrying out the above works, we also energetically launched a mass movement with technical revolution and technical reforms as its main goal. Some teams have produced the YKC drilling machine, the mechanical rock drill, and the pipe-making lathe, and have reformulated some methods that are more adaptable to practical conditions as an engineering geology survey "to meet the needs of medium and small-sized reservoir dam sites," a hydrogeology survey "to meet the needs of the medium and small-sized ore beds, and "the method of compiling comprehensive hydrogeological maps" and sample maps (1:200,000 and 1:500,000) to give timely guidance to our work.

The fulfillment of the above works has attained great achievements. We should have a sufficient estimation of these achievements. The cause for our achievements, first of all, is our insistence on the Party's guidance and the mass line for our works. Of the thousands upon thousands of ways, the first way is the Party's guidance; of the thousands upon thousands of policies, the first policy is the mass line. This is the most important successful experience in our works. While we have attained the above achievements, we have also undergone various political movements, especially the eradication of the anti-revolutionists and the rectification movement, purifying the hydrogeology and engineering geology teams, criticizing and overcoming the capitalist reactionary belief that "the Party does not know science and technology and cannot lead hydrogeology and engineering geology works," which values the past and neglects the present, places first importance on technology, and advocates study for the sake of study; such is a capitalist and individualistic working attitude and an erroneous ideological viewpoint. We have defeated the "three attitudes and the five atmospheres" and liquidated the rightist conservative ideology. The masses have universally raised their awareness, positive factors, and subjective ability to the fullest extent, and have promoted the development of the hydrogeology and engineering geology enterprises.

Though hydrogeology and engineering geology works have attained the above achievements, there still exists a number of problems.

First, within the last several years much work has been done. Because the applicable value of the materials has not been fully recognized, the geological materials obtained in the working frequently have not been timely adjusted and studied, seriously affecting the working quality and the making of a timely report. Furthermore, many materials are still scattered over various places. Because no one has the responsibility of collecting these materials and taking care of them, it is possible that they will be lost. Under such circumstances, the various provinces (districts) must

rectify this condition, rapidly collect these materials, adjust them, and formulate a system of control whose function should be fully exerted.

Second, the drilling work has not caught up with the needs of the surface work of hydrogeology and engineering geology works.

In 1957 and 1958 there were 300,000 square kilometers of land that were comprehensively investigated, but since no drilling has been done, this seriously affects the presentation of materials.

Third, hydrogeology professional equipment, especially the tubings, the mechanical drilling machines, the hand-operated revolving drill which is needed for hydrogeological survey, and water pumping equipment, cannot meet the needs for the development of the work. This situation seriously affects the rising of working quality. The various provinces (districts) must energetically solve this problem and effectively pay attention to raising the prospecting quality and efficiency in hydrogeology and engineering geology works.

Fourth, after the decentralization of authority, there are some new problems. Certain provincial bureaus do not have a sufficient understanding of the function of the science of hydrogeology and engineering geology in the construction of the national economy. Thus, attention must be paid to strengthening leadership over the arrangement of works and the equipment supplies. Certain individual provinces (districts) have decentralized the entire authority to the special districts and some provinces have sent their hydrogeology and engineering geology technical workers to some other trades. This is not correct. This practice must be stopped and rectified.

Though there is great development in our works, in order to meet the rapid development of industrial and agricultural production throughout the country, we must make further efforts. On the one hand, we must train cadres and bring up a new strength, improve leadership, raise the working quality, make profound studies in the operation of our practical works, raise our scientific level, energetically learn politics and raise ideological awareness. On the other hand, we must closely cooperate with the other sister units, abolish prejudices, solidify and support, mutually cooperate, and mutually start from the State's entire interest so that the relation between one department and another will further meet the needs of the rapid development in social productive force.

1959 is one of three hard struggling years that has a decisive meaning. The task that confronts hydrogeology and engineering geology workers is very difficult and honorable. Throughout the country, there are 5,000,000 square kilometers of territory that need regional hydrogeology comprehensive investigation. Among these territories there are 1,900,000 square kilometers (equivalent to 1,600,000,000 mou) that are urgently needed for China's national economic development. Besides the 960,000 square kilometers that have been completed, the rest must be completed within this and the next year. The survey work for the improvement of deserts and the transferring of water from the south to the north has already begun. The hydrogeology work in the mining areas and the long-term surveying stations works for underground water must be actively promoted. There are many new

problems that we must begin to study. For instance, there must be a plan for the beginning of a basic standard drilling and the development of deep subterranean water studies; the problem of water supply in the coastal areas, the treatment of swamp areas and briny soils; and the further rising of scientific research works in our practical operations.

In order to perform works well, we must implement Chairman Mao's instructions which says, "Strategically, we must despise difficulties, and tactically, we must pay attention to difficulties." And we must coordinate the sky-high revolutionary morale with the spirit of scientific analysis.

At this meeting it is hoped that everybody will exert the communist attitude of daring to think, daring to speak, and daring to act, and will adopt free speech, free discussion, the large letter wall newspaper, and free debate methods. Everyone must be bold enough to introduce their experiences, bold enough to argue problems, and the more penetrating the debate is, the more thoroughly will the problem be solved. There are some problems that cannot be solved even after some debate, and these should be brought back to practical works to make continuous studies.

Comrades, before the beginning of this meeting, we had a long period of preparation. It is hoped that the various delegates and comrades will concentrate their energy, under the instructions of the delegates from the various sister departments and with the assistance from the specialist comrades, to make this meeting a complete success. Through this meeting, in order to develop hydrogeology and engineering geology works, let the Fatherland's geological sciences march forward.

Finally, let us wish well the victorious success of the meeting, and wish well the good health of all the delegates and all the comrades.

15 May 1959.

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## ACHIEVE THE GREAT LEAP FORWARD IN HYDROGEOLOGY AND ENGINEERING GEOLOGY

[Following is the translation of a speech by Chou Kang (0719 0474), Director of the Bureau of Hydrogeology and Engineering Geology, Ministry of Geology, In Shui-wen Ti-chih, Kung-ch'en Ti-chih, No. 6, 12 June 1959, pp. 51-56.]

Comrades:

The Second National Hydrogeology and Engineering Geology Work Conference is held under the conditions of the First Five-Year Plan having been victoriously fulfilled, the various fronts in the development of the economy having attained all-people and all-out great leap forward in 1958, and the hydrogeology and engineering geology works having achieved great results and accumulating rich experiences. The purpose of this meeting is, principally, to summarize the experiences of the great leap forward of the last several years, especially of 1958, and to raise further theories so as to give guidance to production in order to promote the forward development of this science. At this meeting there are specialists from the brethren countries of Soviet Russia and Poland to give us personal guidance and they will make reports on the advanced experiences concerning hydrogeology and engineering geology works in the Soviet Union and Poland. In addition, we have invited the sister departments and comrades from institutions of higher learning to participate in the meeting to introduce their valuable experiences which will enrich the content of the meeting. We believe that this meeting will definitely be a success. I wish to express my whole-hearted gratitude to the specialists and the delegates from the various sister departments.

### I

Since the Liberation, under the correct guidance of the Central Government and the various levels of Party Committees, the hydrogeology and engineering geology works, on the basis of the great victories attained by the rectification movement in 1958, have earnestly implemented "the Party's general line to arouse high morale, to strive for the upper stream, and to construct socialism in a faster, better, and cheaper manner" and the complete set of policies raised by the Central Government of walking on two legs and the promotion of mass movements.

With the hard work of all the comrades and with the help from the Soviet specialists and those of the other brethren countries, the hydrogeology

and engineering geology teams under the Ministry of Geology reached 8,000, and the number of various types of mechanical drills reached 250. The total area of territories that have been geologically surveyed in various scales reached 1,086,000 square kilometers, while the total amount of drilling works done reached 312,000 meters. In the great leap forward year of 1958 alone, the total number of workers and mechanical drills increased more than twice of those in 1957. The 750,000 square kilometers of geologically surveyed areas, completed under various scales, are more than twice of those in the First Five-Year Plan. The amount of mechanical drilling work of 200,000 meters is equivalent to 1.85 times that of the First Five-Year Plan.

The achievements of the various phases are described as follows:

(1) Hydrogeology works: the regional hydrogeological comprehensive investigation has been completed over 960,0000 square kilometers, including such areas as the North China Plains, the Kuan-chung Plains, and the Huang-t'u Plateau in Shensi Province, the Ho-hsi Corridor, the Shantung Peninsula, the Sung-nung Plains, the Tien-shan North Slope in Sinkiang Province, and the Ch'ai-ta-mu area. Of these areas, 690,000 square kilometers have been completed in 1958, which is the equivalent of two times the amount of that in the First Five-Year Plan. After the comprehensive investigation, a preliminary understanding of the general conditions of the underground water in these areas has been attained and hydrogeology materials are provided to the agricultural planning and the use of water in animal husbandry in these regions. For instance, in 1957 there was an unprecedented drought in Inner Mongolia. Because of water shortage, many animals died off. Through the investigation, the Inner Mongolia Team helped to resist the drought by discovering underground water and made timely a solution of the water shortage problem in the animal farms, making the Mongolian herdsmen feel deeply grateful to the Party's and the Government's consideration.

Within the last several years, following the construction and increase of industrial cities, we have closely coordinated the prospecting work for underground water. We have completed the hydrogeological prospecting works for 36 cities, including Peiping, Hsi-an, Pao-tou, Cheng-chou, Wu-le-mu-chi, Pao-ting, Kunming, Canton, Kuei-yang, etc. Among these, in 1958 we have done prospecting works for the water supply for 34 industrial cities (including seven projects that overlap the year) and we have provided rich hydrogeological materials for water supplies for the industries and residents in the industrial cities. For instance, we have prospected the water supply for the large steel enterprise in Chiu-ch'uan; from prospecting to the submission of the report, the whole process required five months, and it has been discovered that the storage of underground water is 7.3 kung-fang per second, a 40% increase over the needs of the design. In order to expand the medical basis, we have also completed the prospecting work for mineral spring waters at such areas as Hsiao-tang-shan in Peiping and Chi-mo in Shantung Province.

Following the rapid development of the prospecting works for mineral resources, the hydrogeology works in the mining area also have a rapid development and rising. In accordance with the conditions in the

different areas, different mineral ores and prospecting procedures, the hydrogeology works in the mining areas have been systematically carried out. In order to make mining designs for the production departments, we have adopted correct draining measures and provided hydrogeology materials, basically guaranteeing the approval of the mineral storage report. In 1958 alone, mining area hydrogeology works have been carried on by 260 mineral prospecting teams.

In order to hold fast to the law of underground water movements and to coordinate the city water supply, water conservation engineering, regional hydrogeology comprehensive investigation, and other geological prospecting works with the production well of the city industrial and mining enterprises, we have established hydrogeology observation stations in Peiping, Hsi-an, Pao-tou, Cheng-chou, Wu-lo-mu-chi, etc. In 1958, besides expanding five observation stations, five new ones have been established. At the same time, on the basis of an all-country water conservation movement, the mass surveying works have already begun. The Peiping Municipal Surveying Network has been established. The result of the surveying works within the last several years has attained many achievements. For instance, the Pao-tou Surveying Station, based on surveying materials, makes new calculations on the survey of underground water and finds it to be twice as much as the original calculation. Through surveying, preliminary understanding has been attained as to the type of causes for the underground water movement in the regions being surveyed.

(2) In the field of engineering geology: within the last several years, water conservation engineering and geology works have completed plans for the valleys and basins of Huang-ho, Huai-ho, Liao-ho, Han-chiang, Sung-hua-chiang, and the plan for the Ch'ang-chiang area with regard to the main points of engineering geology and hydrogeology works. The engineering geology prospecting works of more than 750 large, medium, and small reservoirs and hydraulic stations have been completed at Kuan-ting, Fu-tzu-ling, Mei-shan, Nan-wan, San-men-hsia, Tan-chiang-kou, and Hsin-an-chiang. Among these, 612 are completed and work has been started in 1958. This number is equivalent to four times that of the First Five-Year Plan. Special mention must be given to the fact that we have completed the main points for the preliminary design of one of the enormous water conservation centers in the world -- the Chang-chiang San-hsia engineering project and the engineering geology prospecting works in the construction surveying for the San-men-hsia reservoir, and also the completion of the surveying works for the Tan-chiang-kou reservoir engineering project, ahead of schedule. We have also participated in the engineering geology surveying works for the Erh and Ta-chi-huang Canals and tunnels, providing engineering geology materials for the water conservation repair and construction and the planning of the valley.

In railway and bridge engineering geology works, during the First Five-Year Plan period, we participated in the engineering geology surveying works for the new railway lines at Chi (Chi-ning)--Erh (Erh-lien), Feng (Feng-t'ai; Sha (Sha-ch'eng); Ying (Ying-t'an); Amoy; Tien (Tien-shui); Lun (Lun-ch'ou); Pao (Pao-chi); Ch'eng (Ch'eng-tu). The all-out engineering

geology surveying works have been completed for the Wu-han Ch'ang-chiang Bridge. We have provided engineering geology materials for the repair and construction of these railways and bridges. Since 1956, large-scale surveying works for the Peiping Subway construction have been carried out.

In addition, hydrogeology and engineering geology works for the Ch'an-chiang Port and a portion of the defensive engineering projects have been carried out.

(3) The hydro-geology and engineering geology scientific research works have firmly implemented the policy of using research works for the service of production. Based on the rapid development of industries and agriculture, in the needs of hydrogeology and engineering geology works and in the plan to guarantee the development of 12 years of scientific research, the fulfillment of the various hydrogeology and engineering geology research items have attained rapid development under the principle of using the task to lead the learning of science and to guarantee the key-points, to take care of development, to strengthen cooperation, and to coordinate production, research, and teaching. In 1956, the original hydrogeology and engineering geology laboratory has been expanded into the hydrogeology and engineering geology research institute. The hydrogeology and engineering geology teams of the various provinces, cities, and autonomous regions have also begun vigorous studies.

The items of research works and the fulfilled tasks included the classification of China's hydrogeology areas, the hydrogeological conditions of the drought areas in the Ho-hsi Corridor, the classification of the hydrogeological types of the mineral beds, mine prospecting by hydrochemistry, radioactive hydrogeology, the study of geological conditions in the Huang-t'u region and the engineering geology conditions of the huang-t'u (yellow soil), the Karst condition in Kwangsi Province, the engineering geology works for the Peiping subways, the Karst areas' engineering geological characteristics of the Ch'ang-chiang San-hsia and the engineering geological characteristics of huang-t'u in the Tao River engineering project, Kansu Province. The promotion of these works have an active promotional function in existing production and they enrich and promote the development of this science.

(4) The promotion of a mass technical revolution and technical reform movement has brought about many creative discoveries and promoted production. Some teams have created the YKC model mechanical drill, mechanical rock drills, tubing lathes, a box for the analysis of water elements, and other equipment. Many teams have used bamboo and wooden water filtering pipes, and created rib filtering pipes. These have economized steel materials and have a definite effect in overcoming the difficulty of pipe shortage.

In hydrogeology and engineering geology prospecting, we have utilized the material prospecting method. Through the utilization of electricity to survey wells, we have surveyed the current rate, the current direction of underground water, the depth of the layer that contains the water, and the thickness of the layer, and we have attained results in this work. We have promoted the pumpless drilling and the dry drilling methods.

Through the liberation of ideology, we have abolished old prospecting methods and created new ones, such as the formation of "the engineering geological prospecting needs in the sites of medium and small reservoirs and dams" (preliminary draft), "the hydrogeological prospecting needs in medium and small mineral beds" (preliminary draft), "the method of compiling comprehensive hydrogeological maps and the sample map (1:200,000--1:500,000)" and the timely guidance for works. In the office work of compiling materials, we have created comprehensive engineering geology maps suitable for the use of medium and small reservoirs, substituting the complete set of complicated maps in the past. These maps raise working efficiency and are convenient for the use of the designers.

We have conducted training classes and used the method of the tutor leading his apprentices. According to incomplete statistics, just in 1958 alone about 560 junior grade hydrogeology and engineering geology technical workers have been trained. At the same time, we have popularized the hydrogeological and engineering geological education, and over 60,000 people have attended classes. We have also edited and published over a dozen popular pamphlets and books.

In short, within the last several years, under the Party's correct guidance and consideration, hydrogeology and engineering geology works have started from nothing and have built into something, attaining enormous accomplishments. We have fulfilled the difficult but honorable task that the State has assigned to us. We have provided the necessary hydrogeological and engineering geological materials for the construction of the national economy. At the same time we have trained and strengthened the strength of the professional teams and have created an excellent basis for the more rapid development of the hydrogeology and engineering geology enterprises in the future.

## II

During the last several years, hydrogeology and engineering geology works have firmly implemented the Party's various policies and have attained enormous achievements. Especially in 1953, we insisted on political prominence, reliance on the masses, and the adoption of the mass line in works and the promotion of a mass movement, enabling hydrogeology and engineering geology works to realize a great leap forward and to accumulate rich experiences. The attainment of these experiences is very valuable for the rising and development of hydrogeology and engineering geology enterprises in the future. The principal experiences are:

(1) Experiences have proved that on the basis of the preliminary understanding of regional hydrogeology and engineering geology materials, the hydrogeology and engineering geology works must adopt the working method of coordinating regional works and professional works. This type of working method correctly reflects the general line under which the socialist construction can be done in a faster, better, and cheaper manner. It has a very important meaning in the over-all enforcement of the hydrogeology and engineering geology works. Only through the understanding and the con-

trolling of the regional hydrogeology and engineering geology conditions can we have a more correct guidance to find out the direction of the underground water and to select good geological conditions for the engineering construction sites. It may be used as a guide for further professional works. Just as in mining prospecting, without regional works we do not know where the mineral ores are located and whether there is any future in a mining area. Under such circumstances, any arrangement for prospecting works will be aimless.

When we make regional hydrogeological and engineering geological comprehensive investigations with the scales of 1:2 00,000 and 1:500,000, we are trying to understand the regional hydrogeological conditions, to enable the various areas to formulate industrial, agricultural, and animal husbandry plans and to serve as a basis to further the various professional hydrogeology prospecting. Accordingly, in doing hydrogeological prospecting for water supply to the cities, we must coordinate the regional survey in a large sphere with the proportional survey in a small sphere. If we cannot hold the regional hydrogeological conditions, even if we put in a larger amount of work, we cannot attain the predicted storage amount. On the contrary, if we do not carry out a detailed prospecting in a certain area, we can neither reach the design specifications. Neither of these two can be neglected; otherwise, it will bring about errors and bad results to the arrangement of changing city planning.

In carrying out the works in the mining areas, attention must be given to the holding of regional hydrogeological conditions. Otherwise, because of the lack of this understanding of the regional hydrogeological conditions, the arrangement for the amount of works will be aimless. No matter whether it is the hydrogeology works for the mining area or water supply, if we aimlessly drill a few hydrogeological holes, it is obvious that we cannot attain any good result.

In carrying our engineering geological prospecting works for a valley planning, we can provide the terrace selection with good geological conditions and the engineering geological materials needed for the land development. These materials will have a guiding effect on the detailed prospecting in professional engineering geology. For instance, in order to compile a comprehensive utilization plan and the technical and economic report of the Yellow River, we have made several surveys over the entire river valley and made professional engineering geological surveys over 100 dam sites. We have selected 46 terraces and decided to use the San-men-hsia and Liu-chia-hsia as the goals for the first period of the engineering project; otherwise, the arrangement for the water conservation center will be irrational. Thus, it will affect the reasonable utilization of water conservation resources.

In addition, while we are carrying out regional works, attention must be given to the close coordination between the water supply needed by the existing constructions in the cities, the farm irrigation needs, the dam sites of reservoirs, roads, bridges, ports, industries, and the bases of civilian constructions and the professional hydrogeology and engineering geology prospecting.

Through professional works, it is possible to supply hydrogeology and engineering geology materials needed by design and construction works in industrial and agricultural constructions. And it is possible to attain a further understanding of the hydrogeological and engineering geological condition in that area. Regional works will guide professional works, which in turn will enrich the contents of regional works.

(2) The amount of work required by hydrogeology and engineering geology is determined by the task of the work, the designing needs, the realistic meaning of the national economy, the complexity of hydrogeology and engineering geology conditions, and the possession of materials and other factors.

The formulation of the work norm for geological surveying, prospecting, and experiments and the adoption of the specification of proportional scale in geological surveying commonly are determined by the general conditions and must be separately applied in accordance with the over-all conditions. For instance, the comprehensive investigation must be based on the regional national economic meaning and the complexity of hydrogeology conditions to adopt separately the proportional scale of 1:200,000 or 1:500,000. City water supply prospecting should also be based on the needs of the storage amount and the hydrogeological conditions to arrange separately the different amount of prospecting.

The Ch'ang-chiang San-hsia engineering projects possess important national economic meaning; the amount of work must be greater and a larger proportional scale must be used. When we carry out comprehensive investigation works in areas where the hydrogeological and engineering geological conditions are similar, and when the regional hydrogeological conditions are understood, the amount of surveying work in the overlapping maps should be properly reduced. In areas where there are many hydrogeological and engineering geological materials, through analysis and study, for instance in the comprehensive investigation, we should fully utilize all the materials that can possibly be utilized and that are related to civilian wells; thus, the amount of surveying work can be greatly reduced. When we carry out comprehensive investigation for hydrogeological conditions in the Huang-t'u Plateau, we should stress the study of the geological conditions for drawing water up the mountains, and we should seek water in the older layers of earth under the thick layer of yellow soil.

(3) Strengthen the comprehensive geological and hydrogeological investigation and give attention to the comprehensive utilization of underground water resources. The rapid development of national economic construction has an increasingly urgent need for the various types of resources. In carrying out the hydrogeological comprehensive investigation prospecting process, attention must be given to the prospecting of minerals. Within the last several years, in the hydrogeological comprehensive investigations, the various teams have found many mining points. In areas where they are scattered with igneous rock and metamorphic rock, there should be a comprehensive investigation for radioactive elements. In carrying out hydrogeological surveys, an all-out consideration must be given to water draining and water supply. In China there are many coal mines that have the coal

deposit lying beneath the underground water and the water flow is very great, such as the Feng-feng, Chiao-tso, and Huai-nan Mines. Industries, civilian use and hydraulic mining are in need of a great amount of water. Accordingly, the consideration for water draining and water supply must be coordinated, put under unified study, and reasonable utilization in order to satisfy the industrial and agricultural irrigation purposes.

In China the drought areas have a very small amount of rainfall. Besides relying on hydrogeological comprehensive investigation prospecting to solve the problem, it must also rely on the study of geological conditions to draw water across the valley and to make comprehensive consideration of the balancing of water supply. In some areas the temperature of the water in the hot springs has reached 50 to 70°. Besides using this hot water for treatment, we must study to see whether this hot water can be comprehensively utilized for warmth or to generate electricity.

(4) Based on the hydrogeological conditions in the different areas, to hold fast to their characteristics, the water resources can be discovered more easily. The grassy plains in Inner Mongolia are principally the typical erosion plateau composed of continental rocks of the Tertiary Period, while the alluvial deposits of the Quaternary Period are not widely distributed. In the past it was believed that it was very difficult to discover water in this area. Through prospecting, underground water has been discovered in the Third System. This discovery has a very realistic meaning in solving the problem of water supply for the animal husbandry region.

On the North China Plains, Ho-hsi Corridor, and the Ho-tao Plains, the level plains on the mountain fronts generally have one topographic characteristic. In these areas, not only the dividing of subterranean water into zones is very obvious, but also the law of transitioning gradually from the subterranean zone into the self-flowing zone is also very obvious. For instance, in the mountain front slope areas, starting from the Chi-lien Mountains in the Ho-hsi Corridor, the underground water can be divided into the deep subterranean water zone, the shallow subterranean water zone, and the self-flowing water zone. The deep subterranean water zone is contained in a layer of earth, whose thickness is about 150 meters. Its water resource is very plentiful and the water quality is excellent, but the zone is frequently 50 meters underground. The shallow subterranean water zone is generally lying five to 50 meters underground. The water flow from the drilled hole is 1-10/second liter. The drilling can be conveniently done so the shallow subterranean water zone has a very high practical value. In the self-flowing water zone, the quality of the water in the surface layer is very bad, but the subterranean water from the deeper portions is excellent. Again, as in the North China Plains, along the slopes of the T'ai-hang Mountains, these areas contain the richest storage of flowing underground water. Furthermore, under the North China Plains generally there can be found deeper underground a valuable layer of self-flowing water. If this can be reasonably developed, it will be helpful to agriculture.

In the coastal areas, the zone along the sea coast in Hopeh Province, the underground water is generally affected by the sea water. It has been

discovered that under 100 meters from the surface there is the existence of fresh water. Accordingly, in the process of prospecting, we must carry out the work layer by layer and section by section in order to understand the transformation of water quality under the effect of sea water. In the areas on the Lei-ch'ou Peninsula, the surface is generally covered by basalt, but once the basalt is broken through, there is a layer of earth of the Quaternary Period which contains a rich supply of water. It is a self-flowing water layer and the water quality is excellent. The practical illustrations from the hydrogeological prospecting in Chi-nan and Lai-wu, Shantung Province, and the spring water from the Yu-ch'uan in Peiping have well explained that the Karst water of the Ao-tao system in North China possess practical value. The future hydrogeological prospecting works of mineral ores and the comprehensive investigation of North China should stress the study of the Karst water of the Ao-tao System.

In the O-erh-to-ssu area, Inner Mongolia, when we were prospecting for oil, we met self-flowing water in the Cretaceous layer. Many people in Ssu-p'ing City, Kirin Province, believed that the basic rocks formulated a water-dividing ridge so it was hard to obtain any water. But in 1958, in prospecting for a water supply, we discovered self-flowing water in the Cretaceous layer of soil.

The above illustrations have well explained that it has an important meaning in holding fast to the natural characteristics of an area to discover underground water resources. In carrying out the works, we must first collect all materials possible, make surface maps, and, after having analyzed the materials in possession, we can hold fast to the key problem; thus, we will be able to use less prospecting work to attain more materials.

(5) Based on different geological factors, we should carry out separate hydrogeological and engineering geological prospecting works in accordance with the needs of the different stages. Hydrogeology and engineering geology works constitute a process to understand nature. Because the degree of complexity of the natural conditions is different, the process of understanding is from shallow to profound. Under the needs of the great leap forward situation after the rectification movement, we carry out great eradication and great establishments, formulating various methods, such as "the needs for medium and small water conservation engineering geological prospecting" and "the needs for medium and small mineral ore hydrogeological prospecting." Based on the difference in natural conditions, these provide different working methods for small reservoirs, mining areas, and medium reservoirs that have simple geological factors and the hydrogeology and engineering geology works in the mining areas. They also hasten the development of the hydrogeological and engineering geological prospecting works.

As to the large and medium important water conservation engineering projects that have complicated geological factors, the water supply prospecting for mining areas and industrial bases must provide materials for the design needs at the different stages.

Small engineering projects should adopt the method of "while surveying, designing is made and construction begins" to carry out the pros-

pecting works, the map making, and the over-all arrangement of prospecting works. In this manner the process of understanding from shallow to profound will be realized.

(6) The coordination between the professional teams with the masses is the basic working method for the realization of the Party's mass line. The masses have accumulated rich experiences concerning the distribution of shallow underground water, its depth, the flowing direction of the underground water, and the good or bad quality of the water. During the last several years, when the various areas carried out hydrogeological regional comprehensive investigation works, the professional teams coordinated with the mass water conservation movement. On the one hand, they instructed the masses to dig wells, to locate springs, to open ditches, and to repair reservoirs, and on the other hand, they utilized the materials obtained from the masses' digging wells to enrich their hydrogeological comprehensive investigation, raising work quality and progress.

In large areas, to carry out underground water long-term observation works, the observation station should coordinate with the masses' observation network and the observation points. In various areas in Peiping and Shensi, under the guidance of the observation station, the various production departments, enterprises and the people's communes are organized to carry out observation, to compile the masses' observation materials in accordance with the unitary principle of hydrogeology for comprehensive analysis and utilization in order to obtain better results.

(7) To promote a mass movement with technical revolution and technical reform as its main goal is an important method of arousing a high-tide in production. According to incomplete statistics, in 1958 in promoting the technical revolution and technical reform movement, there were 200 creations made by the workers, promoting production and overcoming many difficulties. In 1958 division of labor was adopted and an experience exchange meeting was held. Through the method of publishing popular reading materials, 201 items of experiences were exchanged, proving that these were effective methods in the promotion of production.

Through the practical application of material prospecting methods, it has been proved that hydrogeology and engineering geology works have attained better results. For instance, various areas in Kiangsi, Szechwan, and Hopeh Provinces have utilized the electrical well surveying method to survey the current rate and the flowing direction of underground water, and to ascertain the depth and thickness of the layer that contains the water. They have utilized the joint cross-section method to determine the thickness of the covering layer and to find out the position of the fault shear zone and the direction of its continuation. They have also utilized the natural electrical increasing volume method to survey the effective radius during the pumping of the water. All these methods have attained preliminary results. These also have proved that material prospecting is one of the prospecting working methods that meets the needs of a faster, better, and cheaper method which should be further expanded.

During the last several years there are certain defects in our works which are principally shown in:

First, the drilling work in the hydrogeological comprehensive investigation has not caught up with surveying and map making. Within the last several years, surveying and map making have been completed in over 960,000 square kilometers, but drilling has covered only 600,000 square kilometers. We have seldom used shallow drilling so our report cannot be completed in time and the maps cannot be compiled in time, seriously affecting the wide use of the materials.

In addition, the work of compiling and publishing hydrogeological maps is also falling behind the needs of the objective conditions. In order to produce these maps rapidly for the use of production, teaching, and research departments, efforts must be given to solve this important problem.

Second, some comrades have not a sufficient understanding concerning the raising of work quality. They have stressed more and faster, but neglected better and cheaper. In the comprehensive investigation surveying and map making works, without any basis they have used a point to substitute for a line and a line to substitute for an area, and they have improperly reduced the necessary amount of work, affecting the division of the various layers of the earth, the understanding of each layer of soil that contains water, and the recognition of the causes for their topographical formations. Furthermore, the professional departments have not paid enough attention to the development of professional equipment. Thus, the guarantee for quality has been affected.

Third, in the hydrogeology works in the mining areas, the coordination between geology and hydrogeology works has not been as close as it should be so it has frequently waited until geological prospecting is about completed, then hydrogeology work begins. The study of regional hydrogeological conditions has not been given the proper considerations and the work is restricted to areas under prospecting. In the prospecting area, no proper stress has been given to the prospecting hole drilling and the simple hydrogeological observation works. The analysis of the materials already in possession has been neglected. Thus, the correct arrangement for professional works has been affected. In some places work quality is not very high.

As compared to the achievements we have attained, these defects are secondary. But we cannot neglect any defect which must be strictly and earnestly overcome in our future work.

### III

1959 is a year with a decisive meaning in the three years of hard struggle. On the basis of the 1958 great leap forward victory and its rich experiences, we must continue to oppose conservatism, to liberate ideology, to eradicate prejudices, and to implement the Party's general line for the construction of socialism, and the policy of an all-out leap forward with steel as the outline. The rapid development of socialist construction has raised urgent demands on the hydrogeology and engineering geology works. Accordingly, we must attain a continuous great leap forward on the basis

of the 1958 great leap forward.

The principal task of the 1959 hydrogeology and engineering geology work is the continuation of carrying out the regional hydrogeological comprehensive investigation in the drought or semi-drought areas, to look for underground water resources for industries, agriculture, and animal husbandry; actively carry out the engineering geological surveying for the large water conservation center and the special engineering projects; at the same time, based on local needs, to start the engineering geological surveying for the medium and small hydroelectric engineering projects; further strengthen the hydrogeological works in the mining areas to guarantee a storage report that will meet the needs for designing. Attention must be paid to unite production with the water conservation movement, to promote underground water long-term observation works and scientific research works in order to raise the theoretical level of hydrogeology and engineering geology as a science.

The 1959 over-all task in the regional hydrogeological comprehensive investigation works must continue to be carried out on the Sung-nung Plains, North China Plains, the Inner Mongolian grassy plains, the Northwest Huang-t'u Plateau, the north slopes of the T'ien-shan, the flooded areas of the Yellow River, the delta area of the Pearl River, and the Southwest Karst areas for the hydrogeological surveying and map making over an area of 900,000 square kilometers, with scales of 1:200,000 and 1:500,000; to carry out the hydrogeological investigation over the 70,000 square kilometers of desert areas in the T'eng-ko-li Desert, Inner Mongolia, and the Chun-ka-erh Basin, Sinkiang Province, in order to provide hydrogeological materials for industrial and agricultural construction and for the plan to improve the deserts.

In the hydrogeological works in the mining areas, in order to realize the 1959 great annual production of mineral products, we must provide all-out hydrogeological materials needed for mining designing. Accordingly, professional hydrogeology and simple hydrogeology works are carried out in about 600 mining areas. While the geological survey is completed, hydrogeological materials are also submitted.

The engineering geology work must continue the engineering geological surveying for the preliminary designing stage of the San-hsia Reservoir dam site, the engineering geological surveying for the construction period of the T'an-chiang-kou dam site, the engineering geological and hydrogeological surveying for 130 reservoir dam sites in the various provinces including Chin-sha-chiang, I-feng, Kuan-wang-ting, Nan-ch'ing, Chao-an, T'ao-ch'ing-ho, Pao-chi-hsia, and Ta-hu, and the engineering geological investigation of a line to draw water from the south to the north.

For city water supply works, the hydrogeological comprehensive investigation or surveying for more than 100 cities must be carried out. These cities include Canton, Shao-yang, Mukden, Chin-hsi, Ch'eng-tu, Kunming, Yenan, Ha-mi, Foochow, Lin-i, Tzu-po, Yen-t'ai, Hsi-lin-ho-te, Wu-ta, Lin-fen, Yang-ch'uan, Kung-tzu-ling, etc., in order to provide hydrogeological materials for water supplies to the industries and the cities.

In the field of underground water long-term observation works, in

accordance with the principle of common agreement and division of labor, and based on the unitary theory of hydrogeology to carry out an all-out planning in order to coordinate with hydrogeological comprehensive investigation and prospecting and the water conservation movement, we must rapidly establish, in accordance with a step-by-step plan, underground water observation stations, networks, and points, and promote hydrogeological observation works. The various provinces to establish a general station to take charge of the leadership over the underground water observation works and establish a number of observation stations to serve as the basis for observation works, must unite and rapidly promote the mass observation works in order to provide materials concerning the transformation of underground water movements for the industries, agriculture, and animal husbandry.

The hydrogeology and engineering geology research works must earnestly implement the principle of using scientific research to serve production. From now on, we must continue to promote energetically over 30 items of research works such as hydrogeological studies in drought areas, hydro-chemical mining prospecting methods and radioactive hydrogeological studies; the study of prospecting methods; the hydrogeological study of mineral water and mineral ores; the study of water level of the underground water and the perpendicular zoning; the study of the engineering geological conditions for large water conservation centers; the engineering geological study of yellow soil and clay soil; the study of the limestone Karst and frozen soil and the regional engineering geological study, etc. In order to satisfy the needs for hydrogeological and engineering geological materials by the industrial and agricultural leap forward, we must adopt the method of while prospecting, submitting the materials so that the related units may use them in time. As soon as the comprehensive investigation survey is completed, we should submit our reports immediately.

According to the decision of the map-making meeting, we must fulfill the map-making task for 715,000 square kilometers within this year. In order to provide timely hydrogeological materials for regional planning so that scientific research organizations and teaching departments may use them, we must energetically promote the map-making work and we must publish the maps as soon as possible.

In order to realize the 1959 great leap forward plan for hydrogeology and engineering geology works, we must earnestly implement the spirit of the Eighth Plenary Meeting of the Sixth Party Congress, insisting on political prominence, continuing to oppose conservative ideology, eradicating prejudices, promoting the communist attitude of dare to think, dare to say, and dare to act, and coordinating the sky-high revolutionary spirit with the factual spirit of scientific analysis. In order to accomplish this, we must do the following:

(1) Insist on political prominence and strengthen the Party's leadership over hydrogeology and engineering geology works. Within the last several years, we have undergone several social reform movements, especially the great rectification movement and the great victory in the

anti-rightist struggle. The leaders' "three attitudes and five atmospheres" have overcome obstacles; the individualist ideology of the capitalist class has met with criticism; because of the strengthening of socialist and communist education, political ideological awareness has been further raised, consolidating the Party's leadership over hydrogeology and engineering geology enterprises.

Under the Party's leadership, we must continue to implement firmly the control system of "two participation, one reform, and three coordinations." Just as Premier Chou En-lai had said at the First Session of the Second All-China People's Congress in a report concerning the government's works, "All industrial enterprises must implement the system of responsibility by the director of the factory, under the guidance of the Party, and must firmly obey the reasonable and essential regulations and systems. In production and construction, irresponsibility and violation against regulations and system cannot be tolerated.

"But, the kind of concentration we wanted is the concentration on the democratic basis. Concentrated leadership must not interfere with the promotion of the masses, but it should guarantee the promotion of the masses. We must actively lead the workers through the workers' delegates' conference and other meetings, and adopt the forms of free speech and free debate to discuss the stipulated tasks of the State's plan, to contribute opinions, to offer methods, and to struggle for the fulfillment and over-fulfillment of the task.

"The enterprise's important meeting must attract the cadres of the basic level units and the active elements of the masses to participate. All decisions concerning important problems must solicit their opinions. All the methods that were effective in promoting mass movements in 1958, such as the secretaries of the Party Committees assuming leadership, the leading cadres promoting 'experimental farms,' holding on-the-spot meetings, visiting, judgment, and comparison, launching red flag competitions, cadres participating in labor, workers participating in control and the method of coordinating leading members, technicians, and workers, all these must be continued, strengthened, and raised."

In order to improve the leading method, we must unite the masses and lead them to preserve a regular revolutionary enthusiasm and a sky-high morale and to march forward along the correct road to socialist construction. Under the guidance of the various levels of Party Committees, we must organize the workers to learn politics, to promote universal socialist and communist education, give attention to criticism and rectification of capitalist ideology and the various kinds of unfavorable inclinations. We must continue to raise the level of political theories, reform the non-proletarian ideological viewpoint, establish a viewpoint to serve the people and faithfully serve socialist construction, enabling everybody to have a militant ambition and high morale so that the work will be done in a faster, better, and cheaper manner and to guarantee the fulfillment of the task.

In addition, attention must be given to the workers' cultural and vocational learning. Following the arrival of the production high-tide,

learning must be strengthened. In order to attain good production, we must have good learning. In construction there is only a low morale. We must have a definite level of scientific cultural knowledge in order to possess advanced techniques and tools.. Based on the conditions of different individuals, they should be separately organized, uniformly planned and within a certain period of time all the workers' cultural and vocational knowledge must be universally raised one step further.

(2) Thoroughly strengthen and improve control works, guaranteeing quality and raising efficiency.

1. Regulations, standards, and working specifications are the principal bases for outdoor work. When we have standards, we will have uniform working procedures and methods to guarantee work quality. Through the rectification movement, many obsolete elements have been eradicated from these regulations and standards, eliminating all the restrictions on productive power. For the last year, we have formulated many new regulations and standards. Recently, we have again formulated several types of regulations and standards which will be raised at this meeting for discussion. But the standards set by the Ministry are very general in nature. The various areas should coordinate these standards with local conditions and formulate over-all standards which will meet local needs. They should make constant improvements and supplements. Accordingly, in some provinces which may have one unitary natural condition, they may jointly formulate a more over-all working regulations and working rules which will facilitate the promotion of work, raise working quality, and increase working efficiency.

2. Under the principle of concentrated leadership and the scientific division of labor, we must establish a system of technical responsibility, strictly enforcing the investigation, inspection, scrutiny and criticism systems. The Ministry will strengthen its technical leadership and control over those working items which have important national economic value. Each team should establish a method for the inspection of each unit's work, each map made, and each hole drilled. In the process of inspection, educate the masses so that they will pay attention to the results of their own work.

3. Strict control over the designing of survey works. In designing and reporting works, the approval system must be enforced. The hydro-geological comprehensive investigation, the keypoint engineering geological items, and the keypoint mining area designing and reporting must be scrutinized and approved by the Ministry, while the other items will be scrutinized and approved by the provincial bureau of geology or by the team. Designing is the basis for working. Once the design is well made, the work will be successfully carried out step by step. Generally, hydro-geology and engineering geology works require the formulation of designing, which will have a very good effect on the fulfillment of the task. The hydrogeology works in the mining areas are badly carried out and certain losses have been sustained in these works. In the future, attention must be paid to rectifying them.

Before the report is made, careful consideration of all the materials

should be made. The various levels of control departments should check the report carefully and give remarks, while the leaders and the responsible technicians will sign the report.

4. Collect all available materials in the working area (including such materials as the masses' digging wells, ditches, and springs, the production mining wells, and the old caves), make systematic compilation, research analysis, and then formulate the design for the arrangement of works. This will avoid the repetition of works and the amount of work will be reduced. This also is important in raising the quality of work.

5. Firmly carry out the suggestions made by the experts and organize vocational learning. Science is constantly developing and we must insist on the system of learning to constantly raise the vocational level so as to improve our works.

6. The technical leaders must penetrate into the working area and overcome bureaucracy in technology. Only through penetrating into the working area can the technicians personally inspect the works and discover problems which must be immediately solved.

(3) Supplement and improve hydrogeology and engineering geology equipment in order to raise the quality of prospecting. Hydrogeology and engineering geology is a professional phase in the science of geology. The equipment it needs is professional in nature. Especially in prospecting in Quaternary Period rocks, the shocking drilling method must be used in order to attain a good working quality. Accordingly, hydrogeology and engineering geology equipment must be supplemented and improved. First, we must employ the existing mechanical shock drill and the manual-operated shock drill; second, the repair plants in the various provinces must try to produce a number of mechanical shock drills and hand-operated drills; third, within the sphere of each province, we should adjust a portion of the equipment. For instance, recently the two provinces of Hopeh and Shantung have adjusted a number of special drilling equipment. This is a very good illustration. Water pumps and water pressure equipment must also be supplemented and improved so that the working quality will be raised.

(4) Promote mass technical revolution and technical reform. In order to raise productive labor efficiency, and to guarantee working quality, we must broadly and penetratingly promote a mass movement for technical revolution and technical reform. This has a very important meaning. Attention must be given to the following points:

1. The central links in the mass movement must be the raising of productive labor efficiency, increase production, the enforcement of economy and opposition to extravagance. Of course, the prevailing problem in working now is the lack of equipment, which seriously affects working quality. Accordingly, we must pay attention to the improvement of tools, the improvement of equipment, the development of potentialities, the raising of efficiency, the supply of hand-operated shock revolving drill machines, the lever-type water pumps, the study to produce large diameter pipes, and the substitution products for filtering pipes. In addition, we must also pay attention to improving work designs and operation methods so as to economize labor and raw materials, to utilize scrap materials, and to reduce

production cost.

2. Improve geological comprehensive investigation and the survey method, especially the material prospecting method which must be promoted in hydrogeology and engineering geology works. The electrical method to survey depth, the electrical method to survey wells, the electrical method to survey cross-section and the natural electric unit method must be widely applied. In the hydrogeology works in mining areas, besides applying it to coal mine hydrogeology prospecting, it should be applied in the other mineral bed hydrogeology works.

In order to energetically promote the material prospecting method in hydrogeology and engineering geology works, the various provinces must pay attention to training hydrogeology material prospecting cadres in order to accumulate experiences.

(5) Strengthen communist cooperation. The Ministry of Geology, the other sister departments and the hydrogeology and engineering geology teams, within the last several years, under the Party's united leadership, through close cooperation, have fulfilled the various prospecting tasks in hydrogeology and engineering geology works. Consequently, in the future cooperation must continue to be strengthened, relations must be closely established, working experiences must be mutually exchanged, taking the good points to supplement the bad, avoiding repetition of works, and preventing extravagance.

Hydrogeology and engineering geology works are to provide materials for designing and construction. Accordingly, the designing and construction departments must make a clear design map to help the geology surveying works. The geology surveying department must try to understand the map made by the designing department. With the cooperation from both sides, the work will be carried out with a clear purpose.

The hydrogeology works in the mining areas must be closely united with geology works. Hydrogeology works in the mining areas not catching up with geology prospecting works has become a prevailing problem throughout the country. Frequently, prospecting is about to be completed or geology prospecting has advanced one stage before hydrogeology work begins. The causes for this situation are: (1) There is an inadequate understanding that hydrogeology work is a part of geology work; (2) there is a shortage of professional cadres. The methods of overcoming this situation are: (a) the hydrogeology workers will frequently report their works to the administrative and technical leaders, striving for more support and help from the leaders. In the geology prospecting, hydrogeology works must be given entire consideration and unified arrangement. (b) Based on the complexity of the hydrogeology conditions in the mining areas, there should be a reasonable employment of workers; in mineral beds where the hydrogeological conditions are simple, the hydrogeology works can be done by geology workers; the professional cadres should use ordinary equipment, and those cadres who have had more experience should use complicated equipment.

Based on the policy of uniting education and labor, each year there should be a great number of teachers and students who should work hard

and learn how to be thrifty. Accordingly, the production department must have better cooperation with the geology colleges. On the one hand, they must fulfill the production task and, on the other hand, they must train a labor viewpoint among the students and raise teaching quality. As such, the 1959 task will be victoriously fulfilled. This has a very important meaning.

Our 1959 task is very difficult. It is hoped that at this meeting experiences will be fully exchanged, raising the science of hydrogeology and engineering geology, arousing morale, exerting the workers' positive factors, and creatively fulfilling the various 1959 tasks better.

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ON THE HYDROGEOLOGICAL WORK SITUATION OF THE MINISTRY OF GEOLOGY  
IN CPR AND DIRECTION OF FUTURE DEVELOPMENTS

[Following is the translation of an article by T. F. Adzhabiyev,  
a Soviet expert, in Shui-wen Ti-chih Kung-ch'en Ti-chih,  
No. 6, 12 June 1959, pp. 57-60.]

I. The Hydrogeological Work Situation of the Ministry of Geology in CPR

From the history of Chinese culture we know that many centuries ago the Chinese people began to use underground water. Starting from ten centuries before the birth of Christ, at the natural outcrop places, they knew how to install equipment to draw underground water. On the basis of this, they constructed large irrigation systems, dug wells to obtain a water supply, and built dams to prevent floods. In order to obtain briny water and salt, they used bamboo pipes to drill holes. But the feudal system and the imperialists had ruled China for a long time, and the development of scientific technology was obstructed, so the development of underground water science was stopped. Only after the Liberation in 1949 was a favorable condition for hydrogeology work created. Consequently, the science of hydrogeology is one of the youngest departments in New China.

In the rehabilitation period of the national economy and later in the time when the First Five-Year Plan was completed, the function and meaning of hydrogeology works has greatly increased and vigorous development has begun.

In this respect, comparing the amount of investment and the amount of work in hydrogeology in the Ministry of Geology in the various years, these can be used as good illustrations. In 1953, the first year of the First Five-Year Plan, the amount of investment reached 12,500 yuan, but in 1958, the investment reached 28,000,000 yuan. In 1953 the total area of hydrogeological maps made with the various types of scales covered only several hundred kilometers, but in 1958 the total area has surpassed 500,000 square kilometers. In 1953 there was almost no hydrogeological drilling prospecting done, but in 1958 alone about 200,000 meters of drilling has been done. These are enormous figures.

In the first several years of the First Five-Year Plan, the basis for the organization of the hydrogeology working institutions had been created. Measures for the training of hydrogeology technical cadres have been adopted. Equipment has been installed and a scientific center -- the Hydrogeology and Engineering Geology Research Institute -- has been established. All these have guaranteed the rapid development of hydrogeology

works that are extremely essential to the fulfillment of national economic construction.

At present, the hydrogeology workers have attained their consolidated positions among the builders of the new socialist China. Their common, yet honorable and important work, is helpful to the planning and construction of the various types of industries and helpful to the development of agriculture. At the present stage, the direction for the work of the hydrogeology department consists of the following.

1. In areas where there are important industrial and agricultural developments, regional hydrogeological investigation and research is being carried out.

2. In order to solve the problem of water supply for the cities and the large industries, detailed hydrogeological investigation is being carried out.

3. In the different prospecting stages for useful minerals, research is carried out over hydrogeological conditions.

4. A study is carried out in the various typical areas throughout the country to find out the characteristics of the underground water movement, the condition and balance of its formation.

5. An engineering geological investigation has been conducted for the water works, irrigation, and other constructions.

The Hydrogeology and Engineering Geology Research Institute is just studying a series of important scientific tasks. These various topics actually correspond with the State's practical needs. Among them, the following problems especially have realistic meanings:

(1) The hydrogeological conditions in the drought and semi-drought areas in CPR.

(2) The mineral waters in CPR.

(3) The hydrogeological types of the useful minerals in CPR.

(4) The engineering nature of the yellow soil in CPR.

The first regional hydrogeological map in CPR has been compiled and published. A small-scale map for subterranean water in CPR is in the process of printing now. The 1:200,000 and 1:500,000 national hydrogeological map is now being compiled and will be published in the near future.

These achievements are due to the training of hydrogeology cadres and the establishment of professional institutions that lead the practical and scientific work.

The hydrogeological workers, in number and quality, have grown up to meet the needs for the fulfillment of various complicated and important investigation studies.

Accordingly, it is obvious that the hydrogeological enterprise of the Ministry of Geology has attained great achievements within a very short time. But the rapid development of the State's national economy increases every year; thus, its demand on hydrogeological works has become greater every day. Consequently, the effect of hydrogeological work must rise constantly. In this progressive movement, the basic task of hydrogeology work must be to satisfy completely the urgent needs arising from the rapid developments of the State's industries and agriculture. Only through

applying the newest working methods and technical reforms created by the hydrogeology works of the advanced countries can we guarantee the quality and speed of the works and can we fulfill this task.

Based on this observation, we must not only estimate the achievements and merits of the hydrogeology department but attention must also be given to exposing and analyzing the defects in the work. In this way the defects will be overcome more rapidly.

I believe that the principal defects that seriously interfere with the hydrogeology enterprises are the following:

1. In equipment and instruments, the field units and teams do not have enough technical installations. While they carry out the various types of hydrogeological investigations, as to the basic needs of the application of the equipment and instruments, they are the original materials by which good quality is obtained. Furthermore, on the general reliance on equipment and instruments, its utilization, under the premise of not reducing the quality of the hydrogeological materials, in the greatest extent, can reduce the cost of work and the working time.

The principal equipment used in hydrogeological work are the drilling machine and the water pump. There are many types. For different purposes of work, different types of equipment must be used. Accordingly, while compiling the work design instructions, the hydrogeology workers must base on the above principles and adopt the most effective equipment for certain over-all conditions. In respect to hydrogeological instruments, the same principle applies.

At present, the field units and teams do not have the minimum equipment. Especially:

(1) The drilling equipment needed for deep drilling; the mechanical shock drilling machine and the mechanical shock revolving dual-use drilling machine.

(2) Shallow drilling (the depth of the hole is less than 20 to 30 meters) tools; four-inch, five-inch, and six-inch hand-operated shock revolving drill tools and vibrating drilling tools.

(3) The pipes of various diameters used for drilling. Generally each drilling machine has two sets of such pipes.

(4) Laboratory equipment for testing the water that has been pumped out; ATH model deep well pump or electrically-operated water pump, motor-operated air compression machine, screw water pump, lever-type water pump, and others.

(5) The equipment for the compressed water laboratory; the equipment for stopping water.

Similarly, they lack the various types of instruments needed for the hydrogeological investigations (electrical instruments for the survey of water level, the water pressure gauge, the second meter, and the field analysis box, etc.).

The lack of the above equipment seriously affects the quality and efficiency of hydrogeology works. We must give this problem serious consideration.

2. When they carry out the hydrogeological investigation, they do

not carry out the principle of gradual progress from one stage to another.

As we all know, before we can study the general hydrogeological laws, we cannot begin a more detailed hydrogeology work in a smaller area. At the same time, it is very clear that from the general regional investigation to the detailed investigation, the work requires several stages. On the one hand, the work is determined by the complexity of the natural conditions, which are in turn determined by the understanding of the hydrogeological laws existing in the area under study at the particular stage. On the other hand, the work is determined by the task of the investigation to be carried out. Thus, in formulating the work design instructions, consideration in these two aspects is very important; otherwise, serious errors will be done.

Use the hydrogeology work in the mining area as an illustration. Generally, when the geological survey is completed or comes to a close, hydrogeology work then begins. By this time the hydrogeology workers generally begin their work by drilling hydrogeological holes and by testing the water that has been pumped out. Is this the correct way? This is not the correct way because when we do not know the general hydrogeological conditions, that is, the general laws concerning the distribution of underground water, its depth, its circulation, and its supplementary conditions, we cannot correctly arrange the hydrogeological holes nor can we base on these holes to estimate the richness of water in the rocks. The materials so obtained are accidental and cannot be correct. The mining enterprise cannot utilize these materials to make designs.

And if we do not detach from the geological survey to carry out hydrogeology works and do the work by stages, then, while explaining the geological laws, we can determine the hydrogeological laws. Under these circumstances, in the detailed investigation stage it is possible, on the basis of the explained general hydrogeological conditions, to make plans and to carry out hydrogeology works. This guarantees that the investigation will have a correct direction and guarantees the final quality of the materials.

In solving the problem of providing water supply to cities and large industries so as to carry out detailed hydrogeological investigation, the conditions frequently are the same. Here, the basic problem is to study the general laws of the supply, the movement, and the draining of underground water. If we do not know these laws, we cannot estimate the over-all storage amount of underground water in a certain area. Before knowing all the conditions in the area, if we begin to make a detailed investigation, we will be led to great errors with wide differences.

Accordingly, while we are compiling the work design instructions, it is very important to stipulate the order in the various stages of hydrogeology works, and then, attention must be given to the completion of these stages. The above situation not only is related to water supply and the hydrogeological detailed investigation in the mining areas, but can be similarly applied to the other hydrogeological investigations (such as soil improvement and irrigation that require hydrogeology works, and the study of mineral water).

3. Not under all conditions do the various types of hydrogeological investigations carry out the correct working methods. In the Soviet Union, hydrogeology works are carried out in practice in order to set up definite regulations for the various investigations and to meet the needs of the primitive hydrogeological materials. Of course, these regulations and needs are not stabilized without change, but they will change in accordance with the accumulation of experiences, the application of new techniques, and the corresponding working methods. Accordingly, there must be a basis for any change in the working system and any change in the fineness of working quality under every over-all condition.

But, as a matter of fact, sometimes the situation is not so. Very often some individual hydrogeology worker pursues only the amount of work done and neglects the demand for fineness in work. As a result, the primitive materials he has attained do not have a very high quality.

In carrying out hydrogeological surveying and map-making, hydrogeological hole drilling and testing the water so pumped out, this situation is especially serious.

For instance, in making comprehensive geological and hydrogeological surveying and map making, road lines and geological and hydrogeological observation points have been reduced intentionally. The earth layer of the geological body has been simplified and under all conditions, no distinction has been made as to causes for the Quaternary Period alluvial deposits. In studying the material components of the earth layer and its nature, the soil scraping and the digging of experimental ditches have seldom been adopted. In determining the thickness of the covering layer of the Quaternary Period, the depth of the underground water layer and the thickness of the layer that contains the water, the hand-operated prospecting machine is seldom applied to drill and survey. And under all conditions, no detailed description is made in the surveying and map making to explain the situation under which water is obtained (wells, spring, swamps).

In the area under surveying and map making, the materials obtained by some previous persons and the materials obtained from production holes are very frequently not being utilized in the process of surveying and map making, but they are used after the completion of surveying and map making. In drilling hydrogeological prospecting holes, not enough attention is given to attaining the greatest possible rock center rate. In the drilling process the hydrogeological survey quality is not very high. As to how many layers the drilling hole has shown to be containing water, frequently the various layers are not separately studied. The deposits of the rock center are not well arranged. Some even intentionally reduce or eliminate their existence.

In drilling in loose sand and clay layers, there are many defects. Under most conditions, the rock center drill is used to make quick drilling in these layers of earth. Very often they do not use the tubings nor the two-layered rock center drill head. With this method, they cannot attain a correct hydrogeological cross-section. Sometimes, they may omit a certain water-containing layer, nor can they correctly determine the richness of water and the chemical elements of the underground water which may

change at the different depths.

When they make tests on the water pumped from the holes, the water level is often too low and the time for water pumping is rather short. Under some conditions, the diameter of the hole and the filtering pipes do not suit the over-all hydrogeological conditions. All these affect the accuracy of the calculation figures that are needed for the estimation of the richness of water contained by the layers.

4. The team and the technically responsible personnel of the team of the local Bureau of Geology do not carry out technical inspection and give guidance to the quality of hydrogeological investigations.

According to the experiences of the Soviet hydrogeological workers most of the errors made during the investigation are due to the lack of consideration for the characteristics in the natural conditions in the working area. The problem, no matter at what time, lies in the process of designing, for there is no hydrogeological surveying method which is suitable to the special over-all conditions. In the regular process of work, because in the field analysis of practical materials we have clearly understood the local geological characteristics, it is inevitable that in certain degrees, there must be revisions and supplements to the design instructions. Whether there is any error or defect, it is determined by the individual worker's ability, theoretical knowledge, and working experience. If the error or defect is discovered earlier, it will be overcome sooner and the final result will be generally greater.

Therefore, the better organized the assistance given by the technical inspection and working method, the better quality will be the hydrogeological materials.

I believe that starting from the smallest link, to carry out inspection and to give assistance in the working method is the most correct measure. In the field units, the technically responsible persons in the geological and hydrogeological works must inspect the works of the other technical workers, including the work of the chief mechanic. In the process of inspecting works, we must give attention and assistance in the working method, if necessary.

The leader of the team must conduct periodical inspection over the works of the field units, while the local Bureau of Geology, in turn, must conduct periodic inspections over the works of the team.

With these inspections and assistances, it is possible to discover most of the general errors committed by the technical workers. It is also possible to organize technical learning more correctly in order to raise the working ability of the technical workers. We should hold large or small periodic experience exchange meetings.

After the completion of hydrogeological investigation, all the hydrogeological reports must be scrutinized by the scientific technical committee of the Bureau of Geology. In addition, the materials for the large mineral beds and the water supply projects must be approved by the All-China Mineral Reserves Committee.

Furthermore, all hydrogeological investigation materials must be scrutinized, concentrated, and submitted to the All-China Geological

Bureau so that they will become useful reference materials to more technical workers who may formulate plans and make further investigation.

5. In the offices sufficient attention has not been given to the compiling work over the materials obtained by the field units.

In the Soviet Union special emphasis is given to the compilation of field materials. By compilation of field materials is meant the preliminary systematization, analysis, and adjustment of the hydrogeological materials. These materials are obtained from the hydrogeological surveying and map making, drilling prospecting, works on the hills, the drilling of the hydrogeological holes, the penetration testing works, laboratory works, and the long-term observation works. On the basis of the preliminary compilation works in the offices, some field maps can be made (hydrogeological maps, topographical maps, basic rock, and Quaternary Period alluvial deposit geological maps), and the pillar-shaped diagrams for prospecting holes and hydrogeological holes should be made.

In these pillar-shaped diagrams, the water level, the changes in the rock center drilling rate, and the consumption of cleansing liquid should be pointed out. They should study the rock center drilled hole, compile the drilling prospecting diary, compile the materials obtained by the hydrogeological surveying on the hills, compile and draw diagrams and charts based on the results obtained from hydrogeological testing works (water pumping and water filling). Based on the long-term observation materials, they should compile charts for water level, water temperature, and the volume of water flow. Based on the materials tested by the laboratory, they should fill charts and draw diagrams, make hydrogeological cross-section maps, relief maps and professional hydrogeological maps (uniform water level charts, uniform water pressure charts, and chemical component charts, etc.).

In the process of field works, all the practical materials must be systematically compiled. If they are not treated in this manner, hydrogeological investigation cannot be correctly carried out.

Therefore, the compilation work in the field office cannot fall behind the progress of the entire hydrogeological work. This is very important. If the preliminary compilation work of the materials should fall behind, it means that the hydrogeological work is carried out mechanically and the work is not carried out on the basis of the analyzed materials.

I have mentioned in the above that at any certain time we are not able to know beforehand what possible characteristics we may meet in the hydrogeological conditions, so we cannot formulate an accurate working method beforehand. Generally, in the process of investigation, no matter whether it is the working method or the volume of work that have been well designed previously, certain supplements and revisions must be made. These revisions must be based on the results that we have obtained from the various types of hydrogeological investigations.

It is regrettable that in the practical works not all hydrogeological workers have paid attention to this fact. As a result, the compilation work in the field office greatly falls behind the entire working process.

The above-mentioned defects occur directly in the production move-

ment. Undoubtedly, they are the defects that occur in the process of rapid development of the hydrogeological enterprises. To overcome these defects is to raise greatly the result and quality of hydrogeological investigation.

## II. The General Direction of the Hydrogeological Work Development

As it is said in the above, the basic task of the hydrogeology departments is to guarantee the all-out development of hydrogeology work and to enable these works reach the level of the advanced countries. Only when the hydrogeology departments can completely satisfy the many needs arising from the State's vigorous development of national economy can this level be reached.

In order to reach this level, the development of the hydrogeology departments must follow two closely related directions. (1) Develop scientific study and special topic research work; (2) improve the production practical movements between the field sub-unit, the unit, and the team.

At present, the Ministry of Geology, the Bureau of Hydrogeology and Engineering Geology, and the Hydrogeology and Engineering Geology Research Institute are the basic centers for working methods and scientific research. They not only have a great effect and meaning in the development of the hydrogeological enterprises within the Ministry of Geology, but also in the development of these enterprises throughout the country. Accordingly, we must enable this effect to continue to increase.

The Hydrogeology and Engineering Geology Research Institute is just studying some important special topics, but it is regretted that these topics are too few. We must expand the scope of its activities. We must study some theoretical problems that have a great meaning to the hydrogeology workers in China, such as the theory concerning the formation of underground water, especially the transformation of water nature in the drought and semi-drought areas, the zoning problem of underground water, the problem of underground water movement and balance, the theory of the law of underground water movement, the problem of underground currents, the theory of mineral water, the study of hydrogeological symbols for the prospecting of mines, ancient hydrogeology and historic hydrogeology problems, the problem of underground water dynamics, the discussion on the hydrogeological investigation methods and techniques (especially the material prospecting method and the utilization of radioactive isotope problems), the study of new instruments and equipment for hydrogeological investigation. In addition, together with the all-China Bureau of Geological Materials, we must strengthen the systematic treatment of all these materials throughout the country. We should also publish 1:200,000 and 1:500,000 smaller scale national hydrogeological maps.

It is best for the Bureau of Hydrogeology and the Hydrogeology and Engineering Geology Research Institute to unite together to make joint studies and systematic treatment of all standards, methods, and guides for the various types of hydrogeological investigation made by the various de-

partments throughout the country. And on the basis of these studies, they should formulate a national unified working method.

The various local bureaus of geology should continue their plan to study the underground water in the various areas throughout the country, and to carry out regional hydrogeological surveying and map-making, and the long-term study of the underground water movement. Based on unified planning, we must carry out this research work and we must first start in places where there is great meaning for national economy.

While we are studying the general regional hydrogeological conditions, we must special attention to the study of mineral water because it is the State's valuable medical treatment and material resource. And under different conditions, it is an energy resource. Attention must also be given to the consolidation and expansion of hydrogeological works under the local bureau of geology. The local bureau of geology should give guidance to all hydrogeology works within its territory, including the study of mineral products, solution to the problem of water supply, of irrigation, and of soil improvement and the study of mineral water.

We must use new equipment and instruments to strengthen the technical installations of hydrogeology works, to develop the experimental bases, and to adopt the newest methods for investigation. We must strengthen the bureau's scientific technical committee and the national mineral reserves committee so that they are able to inspect and estimate the quality of the hydrogeological materials. Whether it is the material obtained by hydrogeological investigation conducted by the Ministry of Geology or by the other departments, it must be regularly submitted to the care of the Geological Materials Bureau. The compilation of the underground water records must be strengthened.

The above discussion merely deals with some principal problems that must be solved in the future. It can be seen that the development of modern hydrogeological enterprises is very complicated. Undoubtedly, this series of scientific and practical problems must rely on the joint effort of all the hydrogeology workers throughout the country and on the creative cooperation with the experts and scholars of the neighboring scientific departments to solve them. In the field of scientific problems, the Chinese Academy of Sciences will give especially great assistance.

I believe that the rapid growth of the technical cadres and the patriotic enthusiasm of the young Chinese hydrogeology workers will inevitably raise their working ability and knowledge. Recently the great achievements attained by the hydrogeology workers is a guarantee for the fulfillment of the task that confronts the hydrogeology departments.

We Soviet experts fully believe that in the near future the free hydrogeology workers of China will attain great achievements in the development and continuous promotion of their hydrogeological enterprises.

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